Rare-earth recycling using a functionalized ionic liquid for the selective dissolution and revalorization of $Y_2O_3:Eu^{3+}$ from lamp phosphor waste

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Corresponding topic: (1st) Chemical valorization of wastes, (2nd) Alternative solvents (ionic liquids).

To address the shortage of certain critical rare earths, researchers are looking at new ways to efficiently retrieve these elements from user products like magnets, energy-saving light bulbs and batteries.[1] Here a green and highly innovative recycling process for lamp phosphor waste is proposed.[2] The carboxylic acid functionalized ionic liquid [Hbet][Tf_2N] was used to selectively dissolve the valuable red phosphor $Y_2O_3:Eu^{3+}$ from the lamp phosphor waste (80% of the value). This process is a drastic improvement compared to traditional mineral acid leaching method due to the fact that the halophosphate $(Sr,Ca)_{10}(PO_4)_6(Cl,F)_2:Sb^{3+},Mn^{2+}$ is not co-dissolved in the ionic liquid, something which is not achievable in acidic aqueous solutions. The dissolved yttrium and europium were stripped with oxalic acid and calcined to immediately regenerate a highly pure red phosphor with good luminescent properties. This efficient three-step recycling process features a selective leaching, a fast stripping and an immediate revalorization step. Combined with the mild conditions, the full reusability of the ionic liquid and the fact that no additional waste water is generated, this process represents a very green and efficient alternative to traditional mineral acid leaching.

References:

1. Binnemans, K., *et al*., *Journal of Cleaner Production,* **2013**, *51*, 1-22.
2. Dupont, D.; Binnemans, K. Rare-earth recycling using a functionalized ionic liquid for the selective dissolution and revalorization of $Y_2O_3:Eu^{3+}$ from lamp phosphor waste. *Green Chemistry,* **2015**, DOI: 10.1039/C4GC02107J